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The Moderating Role of Bank Performance Indicators on Credit Risk of Indian Public Sector Banks

Siraj K. K. [1 *] Sudarsanan Pillai P.[2] Rajitha Kumar S.[3]
1. Department of Business Studies, College of Technology, Sultanate of Oman
2. Chairman, Board of Studies in Commerce, Cochin University of Science and Technology, Cochin, Kerala.
3. Associate Professor, School of Management Studies, Cochin University of Science and Technology, Cochin, Kerala
* siraj@hotmail.co.in

Abstract
Credit risk is inherent in banking. With its pervasive impact, it poses significant threat to the existence, stability and growth of the banking industry. The present study investigates the moderating role of various bank performance indicators on the relationship between lending and credit risk, i.e., Non Performing Assets (NPA) during the period 2000-01 to 2011-12. The study concentrates on Indian Public Sector Banks. Basically, NPA results from advances. This relationship is often more complex because it is modified by the changes in both bank performance indicators and macroeconomic indicators. The bank performance indicators moderate the relationship between advances and NPA. In order to achieve the stated objectives, the study utilized correlation, regression and ANOVA with moderation effect. The study revealed that the selected bank performance variables exercise a moderating role in the relationship between advances and NPA. The conclusion derived from the analysis can be utilized to improve the credit risk management in banks.
Keywords: Non Performing Assets, Advances, Moderation, Performance Indicators
JEL Classification Codes: G01; G21

1.0 Introduction

Over the past two decades, many empirical studies have been conducted on credit risk and its devastating role on stability, growth and survival of commercial banks. These studies (Funso et al, 2012[i]; Kithinji, 2010[ii]; Boahene et al, 2012[iii]) emphasized that credit risk has vicious effect and its incidence is critical for banking sector stability and growth. Credit risk refers to the possibility that the actual return on an investment or loan extended will deviate from that, which was expected (Conford, 2000[iv]). Although, credit risk is primarily related to lending/advances of commercial banks, continuing interest among researchers and bank regulators motivated studies on the role of macroeconomic variables and bank performance indicators on the credit risk of banks. Such studies (Siraj and Pillai, 2013[v]; Thiagarajan et al, 2011[vi]) mostly concentrated on economic variables and its impact on credit risk, measured using Non Performing Assets (NPA) of banks. The majority of these studies emphasized that macroeconomic variables mediate the relationship between advances and NPA. It is also evidenced by the fact that in a recessionary period, advances cause more NPA, while during economic progress, higher advances need not result in higher NPAs.

As observed, few studies were available on effect of bank performance indicators on NPA of banks. Available studies mostly utilize regression techniques to identify whether bank performance indicators such as capital, borrowing, total assets, reserves etc. influence NPA. A shortcoming of these studies is that it considers these performance indicators as independent variables, exercising control on NPA directly. Such an assumption is not accurate. For example, higher borrowings do not influence NPA directly, but influence the lending since banks will be more selective and concerned in their lending activities. It may be assumed that higher borrowings may result in less NPA. In specific terms, the role of bank performance indicators can be seen as moderating in nature. A moderator is a qualitative or quantitative variable that affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or criterion variable (Baron and Kenny, 1986[vii]).

With this background, in this research paper an attempt is made to study the role of bank performance indicators in the relationship between Gross Advance and NPA of Indian Scheduled Commercial Banks (SCBs). In this study multiple regression technique is used to find the significant moderating variables. A theoretical model is developed considering Non Performing Assets as dependent variable and advances, bank performance indicators and its interaction on advances as independent variables. The rest of the report is organized as follows. In section two a brief review of available literature on the topic of study is presented. Section three explains the theoretical model used, while Section four further illustrates the empirical NPA model. Section five highlights the research methodology. Section six covers the data analysis and the last section concludes the study with major findings.

2. Literature Review

Credit risk hinders credit growth and affects growth of the banking sector. Credit risk means the potential loss due to the nonperformance of a financial contract, or financial aspects of nonperformance in any contracts. For banks, credit risk normally dwell in the assets in its banking book. Credit risk forces banks to provide higher provisions to withstand potential losses, loan restructuring, loan moratorium and above all is a major reason for recessionary pressures and financial crisis.

The credit risk of banks in emerging economy is higher than that in developed economies and the risk is formed by a large number of bank-specific factors in emerging economies compared to their counterparts (Ahmad and Ariff, 2007[viii]). Banking crisis is significantly affected by the macroeconomic environment: the credit risk increases when there is growth in GDP and the share price indices decrease and rise when the unemployment rate, interest rate, and credit growth increase; it is also positively affected by an appreciation of the real exchange rate; moreover, there exists a substantial increase in the credit risk during the recent financial crisis period (Castro, 2012[ix]). A set of studies on credit risk have identified the role of international and national macroeconomic variables and a set of bank specific variables in forming bank's credit risk (Demirguc-Kunt, 1989[x]; Kraft and Jankov, 2005[xi]). There is a significant inverse relationship between the GDP and the credit risk for both public and private sector banks. Both macroeconomic and bank specific factors play crucial role in determining the credit risk of the commercial banking sector (Thiagarajan et al, 2011[xii]). Further, many research studies have analyzed the role of macroeconomic factors influencing credit risk of banks. Such studies confirmed that macroeconomic variables significantly influence credit risk (Salas and Saurina, 2002[xiii]; Jimenez and Saurina, 2006[xiv]; Nkuzu, 2011[xv]).

Thus, literature on credit risk mostly discusses the role of macroeconomic linkages in explaining the behavior of credit risk. A review of these literatures pointed out the need for further study, since most of these studies focussed on macro economic linkages on credit risk, and few studies have conducted on linkage between credit risk and bank performance indicators. Even though many studies have concluded that bank performance indicators are critical in explaining credit risk, studies does not concentrate further on this aspect. Also, there exists studies which highlighted the relevance of bank performance indicators (Ahmad and Ariff, 2007) over macroeconomic indicators in explaining credit risk in developing or emerging economies.

Review of literature also shows that in earlier studies limited attention was given on the role of bank performance indicators on the credit risk of banks. Credit risk primarily emanates from advances and the risk can be explained by the level of Non Performing Assets (NPA). The research question arises in this background is; "Do the bank performance indicators directly influence the credit risk?" These are general observations which need to be tested in order to prove whether the role of bank performance indicators as moderating variables is statistically significant in establishing the relationship between advances and NPA of banks.

3. Theoretical Model

A common NPA model assumes NPA as a primary function of advances. As a result, banks normally use projections of NPA based on level of advances. During periods of recessionary pressures, the bank's tactically control its' advances in order to manage the accumulation of NPA. Although this approach is theoretically acceptable, the effect of other factors that interacts and modifies the relationship between advances and the NPA is significant as well. For instance, it may be hypothesized that higher borrowings force banks to restrict advances to sensitive sectors and high risk projects, thus brings down the level of NPA. Higher deposits on the other hand increase the lending and at times without assessing the project's feasibility in-depth and may result in higher levels of NPA. Accordingly, various bank performance indicators moderate the relationship between advances and NPA of banks. Such moderation requires attention of policy makers so that the influence of these variables can be used while evaluating the effectiveness of NPA management. Various bank performance indicators affect the quality of advances; thereby the relationship can be explained in terms of various performance indicators and their interaction on advances, as shown below;

To explain the effect of borrowings as a moderating variable;

$$NPA_t = (\text{Advance}_t) + (\text{Borrowings}_t) + (\text{Advance}_t \times \text{Borrowings}_t) + e \quad (1)$$

To explain the effect of capital as a moderating variable;

$$NPA_t = (\text{Advance}_t) + (\text{Capital}_t) + (\text{Advance}_t \times \text{Capital}_t) + e \quad (2)$$

To explain the effect of deposits as a moderating variable;

$$NPA_t = (\text{Advance}_t) + (\text{Deposits}_t) + (\text{Advance}_t \times \text{Deposits}_t) + e \quad (3)$$

Accumulation of NPA depends on the advances, and interaction of advances with other variables. A pertinent question that needs to address here is that which bank variables moderate the relationship between advances and NPA.

The observed results suggest that the effect of bank performance indicators on the relationship between advances and the NPA is basically moderating in nature, while the effect of macroeconomic variables on the relationship

between advances and the NPA is mediating in nature.

4. Empirical NPA Model

The above relationship can be better explained using linear regression with multiple predicators, as shown below;

$$NPA_t = b_0 + (b_1 \times Advance_t) + (b_2 \times X_{2\,t}) + (b_3 \times (Advances_t \times X_{2t}) + e \quad (4)$$

Where ;

b_0, b_1, b_2 and b_3 are the coefficients

X_2 is an independent variable, and

$(Advances_t \times X_{2t})$ is the interaction effect of independent variable on advances

Normally, researches that utilized moderation or interaction effect have noticed the issue of multicollinearity. Multicollinearity is a matter of degree, not a matter of presence or absence. If higher the degree of multicollinearity the greater will be the likelihood of the disturbing consequences of multicollinearity. A major problem identified with the model with interaction effect is that the product term which is the interaction is highly correlated with other independent variables. In order to address this problem, two approaches are available namely centered approach, and standardized approach.

In multiple regression, variable centering is often touted as a potential solution to reduce numerical instability associated with multicollinearity (Afshartous and Preston, 2011[xvi]). The use of mean centered variable reduces the problem of multicollinearity, based on the fact that correlation between the product term of the deviations from the mean-transformed variables with these deviations from the mean themselves is decreased by a large magnitude (Cronbach, 1987[xvii])

Using centered value approach, the regression equation is rewritten into;

$$NPA_t = b_0 + (b_1 \times Advance_t) + (b_2 \times X_{2\,t}) + (b_3 \times (Advances_t - \bar{A}) \times (X_{2t} - \bar{X}) + e$$

In this study, standardised approach is used in order to reduce the problem of multi collinearity. Kim (1993[xviii]) explained that the problem of multicollinearity can be removed or reduced substantially by standardizing the linear, quadratic, and cubic terms in the regression equation, while the correlation coefficients with other variables are not affected by this transformation.

5. Research Methodology

The relationship between gross advances and the NPA is more complex than a simple bivariate relationship between a predictor and criterion. It is because of the fact that the relationship is influenced by other economic and bank specific variables. The effect of these variables may be mediated or moderating in nature. Studies (Siraj and Pillai, 2012) identified that the influence of macroeconomic variables on the relationship between advances and NPA are mediating in nature. The effect of bank performance indicators on the other hand is moderating in nature. In theoretical terms, a variable can be considered as a moderating variable if it affects the strength and/or direction of the relationship between a predictor and an outcome. In general terms, a moderator is a qualitative or quantitative variable that affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or criterion variable (Baron and Kenny, 1986[xix]).

In the present study, an attempt is made to establish the effect of bank performance indicators on the relationship between advances and NPA. The bank performance indicators selected here include Borrowing, Investments, Reserves and Surplus, Deposits, Capital and Total Assets. Multiple regression equation, which is explained in the theoretical model is utilized. A preliminary regression equation considering advance and the NPA is done, which is further compared with another regression equation using bank performance indicator as an independent variable. Both Gross NPA and Additions to NPA are included in the NPA.

The data required for the study is collected from Indian Public Sector Banks during the periods 2000-01to 2011-12. The Public Sector Banks are composed of the State Bank of India (SBI), Associate Banks of State Bank of India, and Nationalized Banks.

6. Data Analysis

6.1. The Moderating Relationship of Bank Performance variables on relationship between Advances and GNPA

6.1.1. Relationship between Bank Performance Indicators and GNPA

From the Table No. 1, a positive relationship is perceived between gross NPA and advances. The adjusted R^2 shows that 48 percent of variability in the dependent variable, i.e., the gross NPA can be explained by the change in advances in the case of SBI and its Associates, whereas the same is 35.3 per cent and 39.6 per cent with respect to Nationalized Banks and PSB respectively. From the analysis, it is evident that the established relationship is statistically significant (p value < 0.05).

Table No. 1
Relationship between Advances and GNPA (2000-01 to 2011-12)

	SBI & Associates	Nationalized Banks	Public Sector Banks
X_{ADV}	0.730*	0.008**	0.671**
Constant	1.280E-16	26827.467	-1.962E-16
Adjusted R^2	0.486	0.353	0.396
F Statistics	11.389*	5.461**	8.198**

Note: A single (*) asterisk indicates the coefficients denote significant at 1 per cent level. A double asterisk indicate the coefficient denote significant at 5 per cent level.

Source: Data Analysis

In order to assess whether the bank performance indicators moderate the above explained relationship, regression analysis is further undertaken considering the bank performance indicator and its interaction with advances as separate independent variables.

6.1.2. SBI and Associate Banks

From Table No. 2, it is observed that the relationship between advances and NPA turn out to be significantly positive when bank performance indicators are included in the equation as a moderating variable. The adjusted R^2 increased to more than 90 per cent and indicate that more than 90 percent of the variability in gross NPA of SBI and Associate Banks can be explained by the changes in selected independent variables. The effect of moderation is statistically significant, at the same time when the moderation effect is included, the effect of advances is not found to be statistically significant except when moderated by capital.

Table No.2
Linear Multiple Regression Coefficients, X_{GNPA} as Dependent Variable
And X_{ADV}, X_{IND} and X_{INT} as Dependent Variables

Independent Variables	Borrowing	Investments	Reserves and Surplus	Deposits	Capital	Total Assets
X_{ADV}	1.011	0.123	0.328	0.609	1.188*	0.873
X_{IND}	-0.824	0.140	-0.060	-0.376	-0.662	-0.638
X_{INT}	0.970*	0.918*	0.890*	0.914*	3.058	0.923*
Constant	-0.885*	-0.783*	-0.811*	-0.835*	-0.863	-0.844*
Adjusted R^2	0.973	0.923	0.993	0.982	0.936	0.979
F Statistics	131.42*	44.97*	512.58*	200.27*	54.99*	174.77*

Note: A single (*) asterisk indicates the coefficients denote significant at 1 per cent level. A double asterisk indicates the coefficient denote significant at 5 per cent level.

Source: Data Analysis

6.1.3. Nationalized Banks

From Table No. 3, it is evident that the selected bank performance indicators moderate the relationship between advances and gross NPA of Nationalized Banks as well. In all cases, except when the capital is considered as moderating variable, the adjusted R^2 shows that more than 90 percent of the variability in the gross NPA can be explained by the selected bank performance indicators. The regression model using the moderating effect as an independent variable is statistically significant (F value is significant at 0.05 level). Similar to observed results of SBI and Associate Banks, the influence of advances becomes statistically insignificant while the moderation effect becomes statistically significant.

Table No.3
Linear Multiple Regression Coefficients, X_{GNPA} as Dependent Variable
And X_{ADV}, X_{IND} and X_{INT} as Dependent Variables

Independent Variables	Borrowing	Investments	Reserves and Surplus	Deposits	Capital	Total Assets
X_{ADV}	-0.486	-1.356**	-0.979	-1.216	0.103	-3.185
X_{IND}	-0.400	1.296**	0.925	1.108	0.473	3.086
X_{INT}	0.927*	0.906*	0.899*	0.977*	0.273	0.972*
Constant	-0.840*	-0.823*	-0.823*	-0.895*	-0.129	-0.891*
Adjusted R^2	0.947	0.960	0.948	0.945	0.599	0.951
F Statistics	66.509*	88.609*	67.975*	64.119*	6.479**	71.955*

Note: A single (*) asterisk indicates the coefficients denote significant at 1 per cent level. A double asterisk indicates the coefficient denote significant at 5 per cent level.

Source: Data Analysis

6.1.4. Public Sector Banks

As Public Sector Bank is composed of both SBI and Associates and Nationalized Banks, the result observed above is also valid for PSB. Only 39.6 percent of the variability in the NPA is explained by change in advance. Upon including moderating variables in the equation, the adjusted R^2 becomes significantly positive, i.e., > 90 per cent. From Table No. 4 on an analysis using F-test and its significance, it is observed that the regression equation is highly reliable in explaining NPA of Public Sector Banks. A notable remark from the analysis is the statistical significance of moderation effect, observed from the result of t-test.

Table No.4

Linear Multiple Regression Coefficients, X_{GNPA} as Dependent Variable And X_{ADV}, X_{IND} and X_{INT} as Dependent Variables

Independent Variables	Borrowing	Investments	Reserves and Surplus	Deposits	Capital	Total Assets
X_{ADV}	0.028	-0.553	1.024	-0.261	0.227	-0.329
X_{IND}	0.018	0.627**	1.117**	0.312	0.437	0.386
X_{INT}	0.919*	0.898*	0.881*	0.930*	0.247	0.930*
Constant	-0.837*	-0.809*	-0.806*	-0.852*	-0.118	-0.852*
Adjusted R^2	0.971	0.971	0.990	0.973	0.667	0.972
F Statistics	122.449*	121.941*	365.786*	133.590*	8.348*	126.099*

Note: A single (*) asterisk indicates the coefficients denote significant at 1 per cent level. A double asterisk indicates the coefficient denote significant at 5 per cent level.

Source: Data Analysis

6.2. The Moderating Relationship of Bank Performance indicators on relationship between Advances and additions to NPA

6.2. 1. Relationship between Bank Performance Indicators and incidence of fresh NPA

It is observed from Table No. 5 that there exists a significant positive correlation between advances and additions to NPA. The regression model is statistically significant as observed from the F-test and its significance. Further, advance is a statistically significant predictor in explaining the behavior of fresh NPA, observed from the result of t-test.

Table No. 5

Relationship between Advances and Additions to NPA

	SBI & Associates	Nationalized Banks	Public Sector Banks
X_{ADV}	0.907*	0.017*	0.019*
Constant	-2.022E-17	1173.389	581.182
Adjusted R^2	0.805	0.844	0.839
F Statistics	46.405*	60.334*	58.502*

Note: A single (*) asterisk indicates the coefficients denote significant at 1 per cent level. A double asterisk indicates the coefficient denote significant at 5 per cent level.

Source: Data Analysis

In an attempt to evaluate whether bank performance indicators moderate the relationship between advances and fresh NPA, regression analysis is undertaken considering fresh NPA as a dependent variable and bank performance indicators including advance as independent variables. The analysis is undertaken with reference to SBI and Associates, Nationalized Banks and Public Sector Banks.

6.2.2. SBI and Associate Banks

From the result of data analysis presented in Table No. 6, few major inferences are drawn regarding SBI and Associate Banks. The first and foremost inference is based on adjusted R^2 which highlight presence of significant positive correlation (> 90 per cent) between additions to NPA and selected bank performance indicators. The regression model is statistically significant, observed from F statistics and its significance. Borrowing is found to influence additions to NPA significantly compared to other performance indicators. In all the equations formed, the moderating effect is statistically significant.

Table No.6
Linear Multiple Regression Coefficients, X_{ANPA} as Dependent Variable And X_{ADV}, X_{IND} and X_{INT} as Dependent Variables

Independent Variables	Borrowing	Investments	Reserves and Surplus	Deposits	Capital	Total Assets
X_{ADV}	1.419*	0.510**	0.673	0.633	1.185*	0.786
X_{IND}	-0.852*	0.138	-0.041	-0.021	-0.395*	-0.175
X_{INT}	0.605*	0.517*	0.529*	0.545*	1.881*	0.553*
Constant	-0.552*	-0.441*	-0.482*	-0.498*	-0.531*	-0.506*
Adjusted R^2	0.987	0.937	0.981	0.981	0.972	0.980
F Statistics	275.327*	55.781*	187.087*	191.846*	128.620*	181.042*

Note: A single (*) asterisk indicates the coefficients denote significant at 1 per cent level. A double asterisk indicates the coefficient denote significant at 5 per cent level.

Source: Data Analysis

6.2.3. Nationalized Banks

The relationship between advances and fresh NPA strengthened when selected bank performance indicators were included in the regression equation along with its moderation effect on advances. The adjusted R^2 shows that there exists a significant positive correlation between additions to NPA and selected bank performance indicators. From Table No.7, it is further evident that the regression equation formed is statically significant in explaining the behavior of additions to NPA. The moderation of bank performance indicators is statistically significant based on t-statistics, except when borrowings, and reserves and surplus are used as independent variables. Hence, it is concluded that bank performance indicators are a significant predictor variable and moderate the relationship between advances and additions to NPA of Nationalized Banks.

Table No. 7
Linear Multiple Regression Coefficients, X_{ANPA} as Dependent Variable And X_{ADV}, X_{IND} and X_{INT} as Dependent Variables

Independent Variables	Borrowing	Investments	Reserves and Surplus	Deposits	Capital	Total Assets
X_{ADV}	0.568	0.232	0.158	0.729	0.727*	0.396
X_{IND}	0.047	0.389	0.475	-0.124	0.155	0.216
X_{INT}	0.422	0.419*	0.407*	0.445*	0.131	0.439*
Constant	-0.383*	-0.381*	-0.373	-0.408*	-0.062	-0.402*
Adjusted R^2	0.973	0.976	0.977	0.973	0.876	0.973
F Statistics	133.413*	151.669*	158.289*	133.317*	26.928*	132.770*

Note: A single (*) asterisk indicates the coefficients denote significant at 1 per cent level. A double asterisk indicates the coefficient denote significant at 5 per cent level.

Source: Data Analysis

6.2.4. Public Sector Banks

The analysis further strengthens the observation and enable the researchers to conclude that bank performance indicators and its moderating effect is significantly influence fresh addition to NPA every year. Based on Table No. 8, the following inferences are drawn.

- The adjusted R^2 shows that more than 90 percent of variability in additions to NPA can be explained by the selected independent variables except capital.
- Based on the result of F-statistic, it is inferred that the regression equation is statistically significant.
- The t-test result shows that the interaction effect is statistically significant in explaining the behavior of additions to NPA.

Table No.8
Linear Multiple Regression Coefficients, X_{ANPA} as Dependent Variable And X_{ADV}, X_{IND} and X_{INT} as Dependent Variables

Independent Variables	Borrowing	Investments	Reserves and Surplus	Deposits	Capital	Total Assets
X_{ADV}	0.807**	0.351	-0.451	0.882	0.698*	0.984
X_{IND}	-0.205	0.271	1.083*	-0.276	0.174	-0.370
X_{INT}	0.472*	0.454*	0.446*	0.475*	0.154	0.470*
Constant	-0.430*	-0.409*	-0.408*	-0.435*	-0.074	-0.431*
Adjusted R^2	0.985	0.983	0.996	0.985	0.896	0.984
F Statistics	243.735*	209.133*	1004.21*	237.452*	32.687*	229.998*

Note: A single (*) asterisk indicates the coefficients denote significant at 1 per cent level. A double asterisk indicates the coefficient denote significant at 5 per cent level.

Source: Data Analysis

7. Major Findings and Conclusion

The findings of the regression analysis are in line with observed facts and expectations. The relationship between advances and the NPA is strengthened when bank performance indicators moderate the relationship. The moderating effect is more visible and statistically significant in the regression model and its significance testing. Another major inference from the study is that advance influences additions to NPA significantly than gross NPA of banks. This highlights the need for improvement in current policy where the relationship between advances and the NPA is used as criteria to evaluate the efficiency of credit risk management. The results confirm that bank performance indicators significantly influence NPA of Public Sector Banks. Since Public Sector Banks occupy approximately 80 per cent of total advances and deposits in Indian Scheduled Commercial Banks, the result can be generalized to the Indian banking sector. This result suggests that banks can tactically utilize its performance indicators in managing NPA. Conversely, banks can predict the level of NPA using these performance indicators. The main findings of the present study have both practical applicability and policy implications. The regulatory authority of Indian scheduled commercial banks shall utilize the linkages of bank performance indicators as moderating variables on the relationship between Advances and in developing appropriate strategies to manage credit risk.

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